REMARKS

1. The Examiner's attention is first of all respectfully directed to the official statement of the U.S. Department of Energy that an energy loss in the U.S. electricity production and transmission systems is now ~ 62%. (see, for example, "Energy Policy Recommendations to the President & the 110th Congress", National Commission on Energy Policy, April 2007, www.energycommission.org) In spite of hundreds patent and thousands publications, 20 years long developments and ~\$200MM/year U.S. Government and private expenses, HTS electric bulk or 3D leads or and HTS wire are not yet on an open market due to inappropriate levels and combinations of electro-magnetic (superconducting) and mechanical properties, reliability, durability and workability that have to be competitive with these characteristics of the used now copper 3D or bulk leads or electric wire.

An invention of reliable, durable, and workable HTS ceramics with required mechanical properties and superconductivity enables dramatically decrease energy loss of the electricity transmission systems. Additionally, an application of HTS wire in electrical motors, cables, and transformers would 5-10 time decrease their cost, weight and size-diameter and significantly advance the economy of the United States of America. All of these would decrease on ~25% electric power expenditure and corresponding decrease fossil fuel expenditure of power stations and greenhouse air pollutions of these power stations.

2. As we know, a patent application for original or improved solid/integer macro-material or chemically produced product shall be considered by each one criterion or combination of three following criteria:

a) a composition of physical-chemical phases or other composites or their intermixture, comprising of ceramics or glass or metals or plastic or bio-materials or their intermixture, and

such composition shall be described either in nominal or quantity characteristics or their combination.

b) a distribution or a deposition within invented solid matter or macro-material or product, for example, "sintered ceramic composite lead", of certain physical-chemical phases or composite ingredients or ceramic crystals or crystal grains or geometrical phase configuration or their sizes or material volume structure or material 3D architecture;

c) certain or persuadable levels and combinations of usable advancements achieved due to a use or persuadable applications of the mentioned above criteria a) and b) for quality characteristics of the introduced novel macro-material, for example, HTS ceramics, including, for example, electro-magnetic (superconducting) and different mechanical characteristics or reliability or durability or workability or practical usability in particular areas of material application, for example, in Electrical Engineering or Electronics fields.

The Examiner's attention is respectfully directed to description of our Patent Application 10/826,001, which has a list of fifty (50) references of prior arts.

3. The respectful Examiner objects our patent application 10/826,001 considering, referring, and citing four *US Patents:*

 # 6,010,983 (Topchiashvili & Rokhvarger) *"Method of Conveyor Production ... ",*

 # 5,529,981 (Holloway) *"Process and apparatus for ....",*

 # 5,660,774 (Stangle, et al) *"Process for ...",* and

5,866,515 (Dorris, et al), which teaches *"A superconducting conductor fabricated from a plurality of wires .... A process of ...."* – see Abstract of the Patent.

These four patents teach <u>engineering processes or production or fabrication methods</u>. Controversially with a classification type of the referred about four patents our patent application (PA) # 10/826,001 introduces <u>"sintered ceramic composite lead"</u> or SOLID MATERIAL or SOLID

MATERIAL COMPOSITE, and our newly invented/improved macro-material or useful product has originally achieved structural or texture nano-characteristics and nano-phase composition that result in originally advanced quality, usability, mechanical properties, reliability, durability, and workability of the invented 3D or bulk HTS macro-ceramic product or HTS wire.

Assuming criteria of the above point 2, one specialist with ordinary skills can conclude:

1) all types of solid materials produced or fabricated by processes or technologies that taught in *US Patents # 5,529,981 (Holloway), # 5,660,774 (Stangle, et al), and # 5,866,515 (Dorris, et al)* do not contain silicate glass solid phase in form of nano-thin films or dots, which is one necessary and important component of the PA # 10/826,001 – see "Description ...", incl. the section "Silicone Controlled Phase Transformation" and Fig.1).

2) Patents *# 5,529,981 (Holloway), # 5,660,774 (Stangle, et al), and # 5,866,515 (Dorris, et al)* do not teach ceramic crystal grains or phase disposal or distribution or deposition and solid phase configuration. They also do not teach HTS macro-material nano-structure or HTS product nano-architecture, as our patent application (PA) 10/826,001 does, making in effect or enabling a set of superconducting nano-, micro-, and macro-phenomena.

3) Patents *# 5,529,981 (Holloway), # 5,660,774 (Stangle, et al), and # 5,866,515 (Dorris, et al)* do not teach levels and combinations of quality characteristics or electro-magnetic (superconducting) and mechanical properties, reliability, durability and workability or practical usability of the **produced products** or solid macro-material or HTS products, as our PA # 10/826,001 does, while our PA # 10/826,001 do these for the invented 3D HTS ceramics and their applications in Electrical Engineering and Electronics fields.

Taking in account mentioned above patent criteria and physical-chemical and engineering facts, processes and production methods taught in Patents *# 5,529,981 (Holloway), # 5,660,774 (Stangle, et al), and # 5,866,515 (Dorris, et al)* obviously cannot oppose our PA # 10/826,001 for the "sintered ceramic composite lead" or HTS bulk ceramics, even though these

patented production techniques use one similar raw component from the total set of a number of different raw material components and/or one or a few similar technological operations or parameters from the total set of different technological operations and parameters.

The US patents *# 5,529,981 (Holloway), # 5,660,774 (Stangle, et al), and # 5,866,515 (Dorris, et al)* cannot be used to object our PA # 10/826,001 by two major reasons:

a) a substantial differences in all sets or either raw material compositions or raw material properties or technological operations elements of these US Patents where only single elements or a small part of them coincide or intersect with the same of the our PA # 10/826,001. Therefore these patents teach different technological processes that result in different materials and products with different quality characteristics; and

b) the US patents *# 5,529,981 (Holloway), # 5,660,774 (Stangle, et al), and # 5,866,515 (Dorris, et al)* do not claim or even discuss structural and consumer properties of HTS products, while a focus of our PA # 10/826,001 is a unique set of electro-magnetic, mechanical properties, durability and reliability of the newly invented and really produced "**SINTERED CERAMIC COMPOSITE LEAD WITH SUPERCONDUCTIVE NANO-ARCHITECTURE**" or sintered HTS bulk ceramics or 3D HTS products for electricity transmission or HTS wire.

Thus, all features of the *US patents # 5,529,981 (Holloway), # 5,660,774 (Stangle, et al), and # 5,866,515 (Dorris, et al)* that employs the respectful Examiner in his Art Unit # 1793 of 04/17/2008 are inconsistent to object our PA # 10/826,001. Therefore, referred by Examiner ***35 USC § 103 (a)*** (see Page 4 of the Art Unit # 1793 of 04/17/2008) is not applicable for an objection of our PA # 10/826,001 and there are no reasons to reject our PA # 10/826,001.

4. The respectful Examiner inconsistently opposes the <u>already issued</u> *US Patent # 6,010,983* (Topchiashvili & Rokhvarger) by some features of the previously issued *US Patents # 5,529,981* (Holloway), *# 5,660,774* (Stangle, et al), and *# 5,866,515* (Dorris, et al). For example,

US Patent # *5,529,981 (Holloway)* teaches ceramic melting process to produce bulk material after cooling of the melted (liquid) HTS ceramic particles up to solid condition of the invented bulk material. The melting process automatically breaches morphology and therefore superconductivity of the individual HTS ceramic crystals. Therefore, hardened plurality of such broken crystals cannot theoretically and practically obtain significant superconducting effects for produced macro- or bulk- or 3D-ceramics. Thus, US Patent # *5,529,981 (Holloway)* cannot be used even as a prior art for our PA # 10/826,001, where we use ceramic sintering process to keep initial morphology conditions of the most HTS ceramic crystals and crystal grains within sintered (stone-like) ceramic body or 3D or bulk HTS ceramics.

We would like to note that the respectful US PTO Examiner of our *US Patent # 6,010,983*, Mr. Mark Kopec did not put in "References Cited" the previously issued US Patents # *5,529,981* (Holloway), # *5,660,774* (Stangle, et al), and # *5,866,515* (Dorris, et al) since these three US Patents are obviously irrelevant to our *US Patent # 6,010,983.*

Nevertheless, in the list of references of our PA # 10/826,001 we referred under #16 a publication of Dorris, S.E., Ashom, N., Truchan, T. & Vasanthamohan, N., as one example of the scientifically and practically inappropriate technique, which eventually has been patented as # *5,866,515* (Dorris, et al), as some potential novelty.

5. In the list of the references of the Description of our PA # 10/826,001 we intentionally referred (see No.-s 30, 31, and 32) engineering review, fundamental book/textbook, and handbook since they data and statements are much more persuadable than some data and statements of the patents that are referred by the respectful Examiner. However, we would like to highlight our knowledge of the nano-scale problem.

1) As defined Nobel Prize laureate Robert Feinman, to control nanofabrication of novel and advanced macro-materials and solid products we have to manipulate nano-size crystal groups (www.zyvex.com/nanotech/feynman.html).

2) As defined Nanotechnology-Handbook, "Nanometer Structures: theory, modeling, and simulation."(Published by ASME and SPIE, Editor I. Lakhtakia, New York, NY, 2004), for ceramic nanofabrication one shall manipulate with ceramic crystals that have in size a few nanometers (nm) taking in account unavoidable physical forces that usually induce crystal aggregations into up to 100 nm in size crystal grains.

3) As stated in a state-of-the-art publication (Alan Rawle, "Nanoceramics – Stepping Back To The Future", American Ceramic Society Bulletin, (2007) Vol. 86, No. 11, pp. 38 – 39), due to theoretical restriction conditions, any mechanical milling process **cannot** result in ceramic powder particles sizing less than one micron or1000nm. The same publication also defines that any ceramic nanofabrication process has to use raw ceramic crystal grains of up to 100nm in any size dimension for each one crystal grain, and such nano-size ceramic crystal grains can be produced only by the use of chemical precipitation methods. It is obvious for obvious up-to-date engineering knowledge that ceramic powder or particles, which is not defined, as nano-powder or nano-particles, can be powder or particles of any fine or course size, which includes particles having sizes either more 1000nm or > 0.1μm or both size ranges.

Thus, the respectful Examiner (in the Art Unit # 1793 of 04/17/2008) objects our PA # 10/826,001 using US Patents # *5,529,981 (Holloway)*, # *5,660,774 (Stangle, et al)*, # *5,866,515 (Dorris, et al*), and # *6,010,983 (Topchiashvili & Rokhvarger).* that do not consider nano-scale nano-structure of the sintered solid ceramics, and, consequently, all nano-scale arguments of the Examiner are inconsistent and do not applicable to our PA # 10/826,001. Therefore, cited by the Examiner statements and rules of ***35 USC § 103 (a)*** (see Page 4 of the Art Unit # 1793 of 04/17/2008) are not applicable for rejection of our PA # 10/826,001 using the US Patents #

5,529,981 (Holloway), # 5,660,774 (Stangle), and # 5,866,515 (Dorris). However, we do not object to put them in the list of the prior arts as may be hundreds other patents and publications.

6. Until April 2004 we did not disclose our PA # 0/826,001. Meanwhile the described in our PA # 0/826,001 HTS-CSP (ceramic-silicone processing method to produce HTS sintered ceramics) macro-ceramic products with extraordinary superconducting and consumer properties were validated by a few groups of internationally recognized experts, including those from Polytechnic University, Brooklyn, NY and Brookhaven National Lab, NY. Below we submit a list of six peer-reviewed publications and ten presentations that we provided at American Ceramic, Mechanical and Chemical Engineering, Materials Research, and NSTI Nano-Tech. society meetings. As you can see, the U.S. and international specialists well accepted our innovation, which includes the world-known definition of the nano-scale range for the ceramic phase elements or raw particles, as equal to or **less than** 100nm (0.1μm or 0.1micron) in size.

<u>Publication and Presentation Portfolio</u>

1. On October 25, 2007 Dr. Rokhvarger presented an innovation - *Cost-effective Nanofabrication of 3G Superconducting Ceramic Wire* at the "Mid Atlantic Technology Trends/ Innovation Competition & Expo" (The Mansion Fairleight Dickinson University, Madison, NJ) where this innovative project won the Electronics, Advanced Materials & Manufacturing award of the New Jersey Technological Council.

2. Rokhvarger, A. & Chigirinsky, L. "Nano-Engineering of Superconductor Ceramics", *Mid Atlantic & Aviation Technologies "Looking Toward Tomorrow",* July 17, 2006 – F.A.A. technical Center, Pomona, NJ.

3. Rokhvarger, A. & Chigirinsky, L. "Design and Nanofabrication of Superconductor Ceramic Strands and Customized Leads" *International Journal of Applied Ceramic Technology,* (Nanotechnology), The Am. Ceramic Soc., Westerville, OH, Vol.1 No.2, pp.129–139 (April 2004)

4. Rokhvarger, A. & Chigirinsky, L. "Engineering of Superconductive Ceramics", *Journal Electronic Packaging,* American Society of Mechanical Engineers (ASME), Vol. 126, #1, pp. 26 – 33 (March 2004)

5. Rokhvarger, A. "Cost-effective Nanofabrication of 3D Nanostructured Superconductor Ceramic Wire and Customized Electric Leads", *NSTI Nanotech; The Nanotechnology Conference and Trade Show*; Boston, March 7 – 11 2004, Program Guide, p.7. *(Presentation)*

6. Rokhvarger, A. & Chigirinsky, L. "Novel Nanotechnology of Usable Superconductor Ceramics":

a) <u>*Presentation*</u> – 105th Annual Meeting & Exp., Am. Ceramic Soc., Apr.27–30, 2003, Nashville, TN, Abs. book, pp.61-62; and

b) _Publication_ – pp. 163 – 170 in Ceramic Transactions, Vol. 148, *Ceramic Nanomaterials and Nanotechnology II*, Edited by M.R. De Guire, M.,Z. Hu, Y. Gogotsi, and S. W. Lu. The American Ceramic Society, Westerville, OH. 2004

7. Rokhvarger, A. & Chigirinsky, L. "Unconventional Nanoparticle Technology of Superconductor Ceramic Articles":

a) _Presentation_ – 2003 Materials Research Society (MRS) Spring Meeting, April 21–25, San Francisco, CA, Abstract book p.345; and

b) _Publication_ – pp. 49 – 54 in MRS Symposium Proceedings, Vol. 776, *Unconventional Approaches to Nanostructures with Applications in Electronics, Photonics, Information Storage and Sensing,* Ed. by O.D. Velev, T. J Bunning, Y Xia, and P. Yang. Materials Research Society, Warrendale, PA, 2003

8. Rokhvarger, A. & Chigirinsky, L. "Adhesive Coated HTS Wire and Other Innovative Materials":

a) _Presentation_ – 104th Annual Meeting & Exp., Am. Ceramic Soc., Apr.28–May1, 2002, St. Louis, MI, Abstract Book, pp.198-199; and

b) _Publication_ – pp.375–384 in Ceramic Transactions, v.140, Ed. A. Goyal, W. Wong-NG, M. Murakami, and J. Driscoll, *Processing of High Temperature Superconductors.* The American Ceramic Society, Westerville, OH, 2003.

9. Rokhvarger, A., "Ceramic-Silicone Nano-Processing of Superconductor Wire and Other Electrical and Electronic Materials" (invited lecture), SEAM '02 – 8^{th} International Meeting on Search for Electro-Active Materials, Brooklyn, NY, December 7^{th}, 2002, http://chem.poly.edu/pri/seam.cfm *(Presentation)*

10. Rokhvarger, A., Chigirinsky, L. & Topchiashvili, M. "Inexpensive Technology of Continuous HTS Round Wire," *The American Ceramic Society Bulletin*, Vol. 80, No. 12, pp.37 - 42 (2001)

11. Rokhvarger, A. & Chigirinsky, L. "Cost Effective Technology of HTS Ceramic Filaments and Other Materials", Conference, Am. Ceramic Soc., PAC RIM 4, Section High T_C Superconductors – Novel Processing and Applications in the New Millennium, Nov. 4-8, 2001, Hawaii, Abstracts p. 66.

American Ceramic and Materials Research societies (where Dr. Rokhvarger is the current member) published a lot of information about nano-scale range and related nano-scale size definitions in www.ceramics.org and www.mrs.org and in state of the art issue "Nanostructured Materials and Nanotechnology", Ceramic Engineering and Science Proceedings, Vol. 28, Issue 6, Willey (2008), (Edited by S. Mathur and M. Singh, Volume editors J. Salen and D. Zhu). American Standard Testing Methods issue, which state all-American standards, ASTM E2456 defines nano region, as 1 – 100nm.

Thus, in contradiction with an opinion of the respectful Examiner, we do not need an especial definition of the nano-scale size of the used ceramic nano-particles, since nano-scale

region is well established scientific and engineering issue. Nevertheless, Figure 3a) of our PA # 10/826,001 defines the maximum size dimensions of larger nano-structural elements, HTS ceramic grains of disclosed superconductive nano-architecture, as 10 – 25nm.

Our PA # 10/826,001 also says in § [0083]: *"Needle-like YBCO crystal grains of about 15nm are oriented, ordered and framed by relatively plastic and much smaller nano-thick glass films and silver dope nano-particles posed in grain boundary areas."*

Thus, a description of our PA # 10/826,001 certainly defines nano-sizes of all nano-structural elements of the invented and claimed 3D nano-structure and nano-architecture of the invented sintered HTS macro-ceramic composite material and nano-fabricated and sintered HTS ceramic composite products or HTS electric leads or HTS wire.

7. Our PA # 10/826,001 improves both a) previously mentioned raw material composition and ceramic-silicone processing method of the *US Patent # 6,010,983*. To provide these improvements, we improved raw material composition of the *US Patent # 6,010,983* and created advanced ceramic nano-technology. Creating this advanced ceramic nano-technology, we employed advanced physical-chemical methods and instruments (optical, scanning-tunneling, and atomic-force microscopes and X-ray diffraction methods) allowing control and identification of the material nanofabrication.

Using words and terminology of the Description of our PA # 10/826,001, we can write that the said nanofabrication comprises of two types of simultaneous processes a) three-dimensional (3D) nano-phase transformation and sintering (hardening) under particularly controlled thermo-chemical impacts and b) 3D nano-structural evolution. All of these processes constitute original physical-chemical nano-characteristics of the solid (sintered) superconductor ceramic macro-material (on nano-level sizes), including 3D uniform crystallographic orientation, required orthorhombic crystal morphology, tight crystal grain alignments, and 3D honeycomb-like

network of nano-sized dots and films that are posed in nano-thick grain boundary areas of the solid ceramic macro-material. Mentioned above original physical-chemical nano-characteristics of the solid (sintered) superconductor ceramic macro-material ultimately constitute an invented superconductive nano-architecture, which then constitutes advanced consumer properties and quality of the advanced and patentable HTS macro-ceramic electric leads (see Description, Figures, and Examples of the PA # 10/826,001).

All our scientific and engineering novelties creatively employ Ceramic Engineering and Polymer Chemistry fabrication techniques, Materials Science and Superconductor Solid Matter Physics, Electrical Engineering and Electronic applications knowledge, methods and techniques altogether with advanced Nano-technology knowledge, methods and techniques. We are sure that any University graduated specialist has to study at least a few references for each one of 50 publications that are referenced in our PA # 10/826,001. This *"ordinary specialist"* has to be familiar with superconductor ceramic raw material properties, ceramic and chemical technology methods, nanofabrication techniques, solid material nano-structure analyzing methods, and advanced and traditional methods, determining quality characteristics of the advanced HTS electric leads. Therefore, definition "one specialist with *ordinary* skills", which repeatable says the respectful Examiner in his Art Unit # 1793, does not applicable for our PA # 10/826,001.

8. As says § [0008], Background section of the Description of our Patent Application # 10/826,001, this invention is further and original advantage, which was not disclosed in any known prior arts, including our previously U.S. patented inventions:

"Our newly invented specific superconductive nano-architecture of the previously invented [1-6] HTS-CSP material and macro leads is very important. Controlling this superconductive nano-architecture, we can control and improve quality of said HTS-CSP material and leads. Some features of the newly invented superconductive nano-architecture of the sintered superconductor composite ceramic material and macro leads from this material were recently published [7-9]."

As says § [0048] of our PA # 10/826,001,

"Guided by physical theories[26-29] and nanofabrication methods[30-33], we created and applied in a lab the ceramic-silicone nano-processing (CSP) method[1-6], which reliably brings the superconductivity of off-the-shelf available HTS ceramic powder particles[34] to engineering usable and versatile customizing macro-ceramic leads including continuous and flexible electric strands. Below we consider the specific superconducting nano-architecture of the sintered macro-material when this nano-architecture comprises the theoretically suggested combination of certain ceramic grain texture and physical-chemical phase composition."

Our PA # 10/826,001 (Rokhvarger & Chigirinsky) substantially modifies *US Patents # 6,010,983* (Rokhvarger & Topchiashvili), # *6,239,079* (Topchiashvili & Rokhvarger), and # *6,617,284* (Topchiashvili & Rokhvarger) in order to bring superconducting properties of the single HTS ceramic crystals to plurality of the HTS ceramic crystals nanofabricated and integrated in particularly formed and sintered (baked or fired or thermo-chemically processed for stone-like integrity and conditions) HTS macro-ceramics or 3D or bulk HTS ceramics or HTS ceramic lead or HTS wire with anticipated advanced properties. Our patent application # 10/826,001 "SINTERED CERAMIC COMPOSITE LEAD WITH SUPERCONDUCTIVE NANO-ARCHITECTURE" introduces improved HTS macro-material with original physical-chemical solid phase nano-composition and their 3D nano-structural or geometrical distribution or topology that altogether result in original and advanced combination of practically important and advanced superconducting electro-magnetic properties and practically required strength, flexibility, reliability, durability, usability, and workability at nitrogen coolant and room conditions/ambience.

We invented high temperature superconducting (HTS) ceramic macro-material with superconductive nano-architecture or 3D HTS nano-ceramics or bulk HTS nano-ceramics or HTS nano-ceramic lead including HTS electric wire. The description of our PA # 10/826,001 includes a list of fifty (50) references of prior arts, including three US patents:

1. Rokhvarger, A. & Topchiashvili, M. "Superconductor Composite Material", # *6,617,284, September 9, 2003*, 10 Claims; Appl. No. 09/788,239,, filed Feb. 16, 2001.
2. Topchiashvili, M. & Rokhvarger, A. "High Temperature Superconductor Composite Material", *# 6,239,079, May 29, 2001,* 18 Cl.-s & 2 Dr.-s; Appl. No. 09/408,209, filed Sep. 29, 1999.
3. Topchiashvili, M. & Rokhvarger, A. "Method of Conveyor Production of High Temperature Superconductor Wire, and Other Bulk-Shaped Products Using Compositions of HTS Ceramics, Silver, and Silicone", *US Patent # 6,010,983, Jan. 4, 2000,* 32 Claims & 3 Drawings; Appl. No. 09/110,580, filed Jul. 6, 1998.

These three multidisciplinary inventions employ state-of-the-art achievements of Ceramic Engineering, Polymer and Colloid Chemistry fabrication techniques, Materials Science and Superconductor Solid Matter Physics, and Electrical Engineering and Electronic applications of the invented HTS ceramics. These three US patented inventions constitute technological manipulations with micro-size **raw ceramic** particles, as it is taught in *US Patent # 6,010,983* result in production of integer/solid HTS materials/products with quality characteristics, as it is taught in *US Patents # 6,239,079* and *# 6,617,284*.

US Patents # 6,239,079 and *# 6,617,284* use the same production technology, which was patented in the US Patent # *6,010,983*. All these patents employ the some raw materials and either the same or similar raw material compositions and the same thermo-chemical production/fabrication method, comprising a consequence of the same technological operations and their parameter ranges.

We substantially improved and modified *US Patents # 6,010,983* (Rokhvarger & Topchiashvili), # *6,239,079* (Topchiashvili & Rokhvarger), and # *6,617,284* (Topchiashvili & Rokhvarger) and created newly patentable HTS nanotechnology, resulting in invented HTS material and HTS products or a HTS electric lead with advanced consumable properties and quality characteristics. To create our PA # 10/826,001, we invented certain novelties in raw material composition and raw material properties and certain novelties in chemical technological parameters of the created HTS nanofabrication process.

It is believed that our originally achieved advancements of our PA # 10/826,001 are of enormous importance.

Submitted in our PA # 10/826,001 nanotechnology has a number of very important originalities and differences with *US Patents # 6,617,284, # 6,239,079, and # 6,010,983.* These originalities include original raw material and raw material preparation processes and different set or flow chart of the thermo-chemical operations and their parameters. These originalities or

advantages or improvements sure cause originality and advantages of both created HTS nanotechnology and custom properties and quality of the produced HTS macro-ceramics or HTS bulk ceramics or HTS electric leads with superconductive nano-architecture of our PA # 10/826,001.

As is says § [0059] *"The HTS-CSP nanotechnology employed nano-science methods of [26 –32] and is comprised of three technological stages incorporating specially developed steps marked below by the asterisk sign*."*

Below we explain the major differences between HTS production technology described in *US Patents # 6,617,284, # 6,239,079, and # 6,010,983* and originalities and advantages of the newly created HTS nanotechnology and HTS macro-ceramics and HTS electric leads with superconductive nano-architecture that are described and disclosed in our PA # 10/826,001.

16 inventions, advantages, and improvements of our PA # 10/826,001 that do not disclose US Patents # 6,617,284, # 6,239,079, and # 6,010,983 and other prior arts

9. 1) The first advancement and improvement, which provides our PA # 10/826,001 comprises of an application of nano-size raw HTS ceramic particles with specific nano-crystal properties. The already patented in *US Patent # 6,010,983 and consequently US Patents # 6,239,079* and # *6,617,284* raw material composition includes micron-sized HTS ceramic particles or HTS ceramic micro-particles, exceeding 1micron. These HTS micro-particles are ranged as 1micron – 1000micron or 0.001mm–1mm. In contradiction with *US Patents # 6,010,983*, Paragraph [0056] of our PA # 10/826,001 defines a size of the used HTS raw ceramic particles as: *"Aggregated YBCO nano- and micro-particles have a mean size value ~ 0.7μm with prevailing orthorhombic morphology[34]."* Meanwhile, ~ 80% of the aggregated HTS ceramic particles have size <1.0*μm*.

Reference [34] in the reference list of our PA # 10/826,001 determines a supplier of our HTS ceramic raw material http://www.superconductivecomp.com/YBCO123SCPowders.htm, which is Superconductive Component Company, Columbus, OH. The Company provides a chemical precipitation of the solid nano-size *YBCO* ceramic crystals from a solution (a mixture of a few liquids), as aresult of the special chemical reactions, that then could be aggregated in crystal grains and grain agglomerates. There are known other companies using similar chemical methods of the production of HTS nano-size ceramic crystals by their precipitation from other solutions, for example, Sachem, Inc., Austin, TX, www.sacheminc.com. It has to be noted, that only chemical crystal precipitation methods can result in production of plurality of morphologically uniform *YBCO* ceramic crystals with required crystal morphology or stoichiometry. Paragraph [0060] of our PA # 10/826,001says:

"*YBCO and silver dope fine powder are loaded in the silicone-toluene solution. Applied ultrasonic vibration* disperses the ceramic particle aggregates up to nano-crystal-grains and homogenizes the multi-component ceramic-silicone suspension/slurry*.*"

Thus, the first important originality of our PA # 10/826,001 or the first difference with *US Patents # 6,010,983* is an application of nano-size HTS ceramic particles that "...*disaggregated from YBCO nano- and micro-particles having a mean size value ~ 0.7μm*..." (see paragraph [0056] of the Description of our PA # 10/826,001). It is easy to conclude that applied ultrasonic disaggregation shall result in ceramic particle sizes of less than 700 nm.

Our PA # 10/826,001 teaches a use of nano-size $YBa_2Cu_3O_{7-x}$ ceramic particles and crystal grains, as the major component of the raw material composition. This technique provides substantial technological effects and substantially advances invented nanotechnology and quality of the invented HTS electric leads with superconductive nano-architecture. It constitutes the first originality and advancement of our PA # 10/826,001 nanotechnology in comparison with technology described in the *US Patents # 6,617,284, # 6,239,079, and # 6,010,983* that do not disclose the same characteristic of the key raw material.

2) The second important originality of our PA # 10/826,001 or the second difference with *US Patents # 6,617,284, # 6,239,079, and # 6,010,983* is the use of *YBCO* raw ceramic particles "*... with prevailing orthorhombic morphology*[34]*.*" This *orthorhombic morphology* of the HTS ceramic crystals is ultimately provided only by originally developed chemical method of Superconductive Component Company, OH. It is very important condition of the superconductivity of *YBCO* ceramics, as it states § [0076]:

> "*Indeed, only $YBa_2Cu_3O_7$ orthorhombic crystals become superconductive at ≥ 77K while $YBa_2Cu_3O_6$ tetragonal crystals are insulators. A subscripting stoichiometric coefficient at the oxygen atom in the formula $YBa_2Cu_3O_{7-x}$ is a statistical estimation of the mean value of the oxygen content in the actually supplied particles*[34] *and in the range $0 \leq x \leq 0.3$ ...* [34, 35]*.*"

We invented a use of *only $YBa_2Cu_3O_{7-x}$ raw ceramic crystals* with prevailing *orthorhombic morphology,* which is defined as a *mean value of the oxygen content ... in the range $0 \leq x \leq 0.3$,* as the major raw material component. This novelty warranties quality and workability of the HTS nano-ceramic lead and substantially advance invented nanotechnology. It constitutes the second originality and advancement of our PA # 10/826,001 nanotechnology in comparison with technology described in the *US Patents # 6,617,284, # 6,239,079,* and *# 6,010,983* that do not disclose the same ultimately required characteristic of the key raw material.

3) The third important originality of our PA # 10/826,001 and the third difference with *US Patents # 6,617,284, # 6,239,079, and # 6,010,983* is a technological operation resulting in *"multi-component ceramic-silicone suspension/slurry"* § [0060] of our PA # 10/826,001 or a dispersion of the solid ceramic particles in silicone polymer liquid solvent while an emulsion is a mixture of non-reacted liquids – see *"... an emulsion mixture of a superconductor ceramic powder, silicone material ..., and ..."* – claims 1, 30, and 31 of the US Patent *#6,010,983.*

We invented a raw material treatment operation technique, which results in a dispersion or suspension of nano-size $YBa_2Cu_3O_{7-x}$ ceramic solid particles in silicone liquid solvent. This originally applied technique provides substantial technological effects and substantially

advances invented nanotechnology. It constitutes the third originality and advancement of our PA # 10/826,001 nanotechnology in comparison with technology described in *US Patents # 6,617,284, #6,239,079, and # 6,010,983* that do not disclose the same technological operation.

10. The second group of the advantages and improvements that provides PA # 10/826,001 in comparison with *US Patents # 6,617,284, # 6,239,079, and # 6,010,983* comprises of the additionally inserted or newly specified thermo-chemical nano-technological operations and their parameters that all substantially improved, modified and advanced HTS technology of the *US Patents # 6,617,284, # 6,239,079, and # 6,010,983.*

4) The fourth important originality or a difference with *US Patents # 6,617,284, # 6,239,079, and # 6,010,983* comprises of the original thermo-chemical treatment mode disclosed in § [0070] of our PA # 10/826,001, as: *"... using an original thermal treatment mode*, we provide slow heating up to ~ 600^0C to burn out the organic part of the silicone additive..."*

This technological operation causes material quality effects and better control of further sintering process. Newly invented and practically realized HTS ceramic heating and organic-burnt-out process has substantial engineering and practical effects and substantially advances invented nanotechnology. It constitutes the fourth originality and advancement of our PA # 10/826,001 nanotechnology in comparison with technology described in *US Patents # 6,617,284, # 6,239,079, and # 6,010,983* that do not disclose the same technological operation.

5) As teaches Ceramic Engineering, ceramic sintering processes can be provided at certain high temperature using one or both different physical-chemical processes. Within formed or shaped ceramic body there are makes place either

a) slow mutual diffusion or transportation of some part of the crystal atoms from one ceramic crystal to another. This results in a breach of the initial morphology of the raw ceramic

crystals and partially integer stone-like ceramic body, comprising of, for example, porous refractory brick or

b) *incongruent–melt-fully-dense-sintering* process, when a small part of ceramic crystal raw mixture or inorganic additives is rapidly or instantly and simultaneously melted at certain eutectic temperature. This results in liquid phase, which sticks altogether ceramic crystal grains. The major or almost all part of the raw ceramic crystals and crystal grains keep their initial morphology, for example, superconductive orthorhombic morphology. During further cooling, this liquid phase is hardened posing in grain boundary areas, as glass films and dots that make ceramic body fully integer or high dense or non-porous, as for example, porcelain.

The sixth important originality or a difference with *US Patents # 6,010,983* comprise of thermo-chemical parameters that are disclosed in the § [0070] of our PA # 10/826,001, as:

"... using an original thermal treatment mode, we provide ... very fast material heating and incongruent–melt-fully-dense-sintering* at $930^0C - 950^0C$."*

The *incongruent–melt-sintering* method or process has a few special advantages and substantially advances invented nanotechnology. For example, this type of sintering do not breach or change sizes and positions of individual crystal grains of the entire plurality of them, which keeps superconductivity of HTS raw crystals and HTS crystal grains.

Newly developed and practically realized *incongruent–melt-sintering* process of HTS ceramics constitutes the fifth important originality and advancement of our PA # 10/826,001 nanotechnology in comparison with technology described in *US Patents # 6,617,284, # 6,239,079, and # 6,010,983* that do not disclose the same technological operation.

6) The sixth important originality of our PA # 10/826,001 or the fourth difference with *US Patents # 6,617,284, # 6,239,079, and # 6,010,983* comprises of thermo-chemical parameters that are disclosed in the rest of the same § [0076] allowing to restore *orthorhombic morphology*

of the HTS ceramic crystals within sintered HTS ceramic body during entire nanofabrication process including thermo-chemical treatment and sintering processes:

"During the heating, the green YBCO-silicone compound loses ~7.5wt.%, which includes non-reversible gases of the burning silicone additive and oxygen of YBCO ceramics while the sintered HTS-CSP composite loses ~2.2wt% of its weight determining the thermodynamically reversible oxygen, which is responsible for rebuilding orthorhombic crystal morphology. There is an amount of oxygen, which is inserted back in YBCO crystals during the thermal oxygenation treatment of the HTS-CSP lead providing at ~ 450^0C."

We invented and practically realized technological flow chart, which incorporates a composition of HTS ceramic cooling and thermal oxygenation processes. This provides substantial engineering and practical effects and makes practical invented nanotechnology. It constitutes the sixth originality of our PA # 10/826,001 nanotechnology in comparison with technology described in *US Patents # 6,617,284, # 6,239,079, and # 6,010,983* that do not disclose the same technological operation.

11. The third group of the major advancements and improvements that provides PA # 10/826,001 in comparison with *US Patents # 6,617,284, # 6,239,079, and # 6,010,983* comprises technological operations that supersede ineffective and complicated technological operations of the *US Patents # 6,617,284, # 6,239,079, and # 6,010,983.* This results in creation of advanced HTS nanotechnology of PA # 10/826,001.

7) The *US Patent # 6,010,983* claims technological process and operation "γ *irradiation of the high temperature superconductor composite material*" – see claims 12 and 21 and technological flow charts of Figures 2 and 3. The goal of this complicated technological operation is providing additional crystal and grain morphological damages that should play a role of vortex pinning centers inducing or increasing superconducting current flow between grains of the macro-ceramic HTS products/leads.

Our PA # 10/826,001 HTS nanotechnology supersedes this "γ *irradiation* operation using *incongruent–melt-sintering* process of HTS ceramics – see [0070] of our PA # 10/826,001. Indeed, the *incongruent–melt-sintering* process provides 3D honeycomb-like network of the nano-thick multi-component silicate glass and silver films and dots, and this network causes vortex-pinning centers, obtaining or increasing macro-superconductivity of the sintered bulk or 3D HTS macro-ceramics. It also allows excluding mentioned above complicated technological operation, substantially simplifying nano-technological process and making it more effective. This also advances quality of the HTS lead or material of our PA # 10/826,001. This advancement constitutes the seventh originality of our PA # 10/826,001 nanotechnology in comparison with technology described in *US Patents #6,617,284, #6,239,079, and # 6,010,983.*

8) The *US Patent # 6,010,983* claims technological process and operation *"sintering in microwave supported electrical furnace"* – claims 14 and 23 and technological flow charts of Figures 2 and 3. Our PA # 10/826,001 HTS nanotechnology supersedes this operation using *incongruent–melt-sintering* process providing HTS ceramic sintering in conventional electric furnace. Indeed, the *incongruent–melt-sintering* process provides a fast and full-dense sintering process of the HTS ceramics. It also allows excluding mentioned above complicated technological operation. All of these substantially simplify nano-technological process and make it more effective, simultaneously advancing quality of the HTS lead or material of our PA # 10/826,001. This advancement constitutes eighth originality of our PA # 10/826,001 nanotechnology in comparison with technology described in the *US Patents # 6,617,284, # 6,239,079, and # 6,010,983.*

9) The *US Patent # 6,010,983* claims technological process and operation Invented and disclosed in our PA # 10/826,001 HTS nanotechnology excludes technological operation claimed in *US Patent # 6,010,983* glue precursor *"... precipitating an adhesive primer... "* on HTS wire silver substrate – claim 17 and technological flow charts of Figures 2 and 3. Our PA #

10/826,001 teaches preparation of "... *ceramic-silicone suspension/slurry*" § [0060] in toluene solvent. This suspension has required viscosity and gluing properties obtaining dip adhesion coating of the metal substrate strand for further thermo–chemical treatment and production of HTS wire (see Fig. 8 of PA # 10/826,001) It allows excluding mentioned above preliminary or additional technological operation providing precursor glue coating of the metal substrate strand. It substantially simplifies nanofabrication of HTS wire and makes it more effective. This advancement constitutes the ninth originality and advancement of our PA # 10/826,001 nanotechnology in comparison with technology described in the *US Patents # 6,617,284, # 6,239,079,* and *# 6,010,983* that do not disclose the same technological operation.

10) Mentioned above nine nano-technological originalities and advancements of our PA # 10/826,001 substantially rebuild and modify HTS technology described in the *US Patents # 6,617,284, # 6,239,079,* and *# 6,010,983,* as it says § [0011] of our initial PA # 10/826,001:

"We altogether invented the sintered ceramic composite lead with 3D superconductive nano-architecture and ***a method of production of the lead,*** *comprising the silicone additive tailored thermo-chemical nanofabrication of the 3D superconductive nano-architecture ..."*

An original application of nano-size raw material composition made possible an original consequence (flow chart) of known and original nano-technological operations that are introduced or disclosed in PA # 10/826,001 – see §§ [0046] – [0054] of the Description of the Preferred Embodiments. We invented *"Nanofabrication of Sintered Ceramic Composite Leads with Superconductive Nano-Architecture"*–see §[0055]–[0071] comprises of simultaneously providing *"Silicone Controlled Phase Transformation" – see* §§ [0072] – [0077] and "*Silicone Controlled Nanostructural Evolution of HTS-CSP Leads*"– see §§ [0078] – [0084]. The invented nanofabrication technique results in "*Superconductivity of the HTS-CSP Strands*" –see §§ [0085] – [0089] and "*Other Leads and Advancements of HTS-CSP Leads*"–see §§ [0090] – [0093].

Thus, our initial PA # 10/826,001 discloses a newly invented nanofabrication or production method, which innovatively combines major ingredients of the raw material

composition and technological operations of the HTS technology disclosed in the previously issued *US Patents # 6,617,284, # 6,239,079,* and *# 6,010,983* with newly invented or original nine nano-size ingredients of the raw material nano-composition and nano-technological operations of the newly invented HTS nano-technology.

The tenth advancement generalizes previously mentioned nine nano-technological advancements, constituting the tenth originality of our PA # 10/826,001 as HTS nanotechnology. The *US Patents # 6,617,284, #6,239,079,* and *# 6,010,983* do not disclose the same HTS nanotechnology.

11) This newly invented HTS nanotechnology results in a unique superconductive honeycomb-like nano-architecture of the full dense sintered, i.e., solid, electricity transferring or conducting lead or HTS bulk macro-ceramics, and said superconductive nano-architecture of the HTS ceramics facilitates and controls unique superconducting or electro-magnetic properties and mechanical characteristics of consumable HTS ceramic products, including multi-strand round HTS wire, which is flexible, reliability, and durability, as copper wire is.

The eleventh originality of our PA # 10/826,001 or the eleventh difference with *US Patents # 6,617,284, # 6,239,079,* and *# 6,010,983* comprises of originally discovered characteristics of the nanofabricated superconductive nano-architecture of fully-dense sintered HTS macro-ceramics – see §§ [0046] – [0054] of the Description and Figures 1 – 3. Our PA # 10/826,001 says in § [0083]:

"Needle-like YBCO crystal grains of about 15nm are oriented, ordered and framed by relatively plastic and much smaller nano-thick glass films and silver dope nano-particles posed in grain boundary areas." Our PA # 10/826,001 also says in § [0084]:

"Thus, HTS-CSP nanotechnology provides a combination of magnetic c-axis grain orientation and 3D silicone polymeric matrix scaffold organizing and fixing nano-grain alignment in a – b crystal planes. These result in a nanofabricated 3D honeycomb-like network matrix of multi-metal-oxide-silicate-glass impurities that provide both electrical percolation and a magnetic vortex-pinning effects and significantly increase superconductivity of HTS-CSP macro-products.

Together with incongruent melt fully dense ceramic sintering and other impacts, these allow nanofabrication of the uniformly organized and certainly superconducting tailored 3D nanostructure of HTS-CSP macro leads and other products."

The eleventh important originality of our PA # 10/826,001 or the eleventh difference with *US Patents # 6,617,284, # 6,239,079, and # 6,010,983* is a result of the application of the invented HTS nanotechnology. First of all, we discovered and disclosed *3D nanostructure* or HTS nano-architecture of the sintered HTS macro-ceramics, as it says § [0082]:

"... Altogether we have uniform 3D nanostructure where YBCO ceramic nano-grains are setting in silicate glass nano-film frames. Obviously, it is the best geometrical structure to provide electrical percolation and vortex pinning networks, as well as the structure, which has the best (for such compound) reliability, durability, ductility, flexibility, and machinability of the sintered HTS-CSP ceramic composite body."

The major features of the invented 3D superconductive nano-architecture of the sintered HTS macro-ceramics are disclosed in §§ [0012] – [0019], as a system, comprising of:

"(A) a physical-chemical phase composition consisting of:
** nano-size superconductor ceramic grains composed of crystals and forming a basic phase elements;*
** additional phase elements constituting nano-thick multi-oxide silicate glass films distributed within grain boundary areas between said grains;*
** further phase elements selected from at least one group consisting of nano-size dope particle, modifier particle, and impurities particle groups, and a combination thereof and said further phase elements are distributed within said grain boundary areas between said grains;* ***and***
(B) a three dimensional grain-cell nanostructure comprising 3D setting network and consisting of:
** said crystals with c - axes oriented substantially perpendicular to a direction of an electric current flux in said lead;*
** said crystal grains substantially uniformly aligned in a – b crystallographic planes; and*
** said additional phase elements and said further phase elements caging and framing said nano-size superconductor ceramic grains and forming nano-size cells comprising said grains surrounding by said additional and further phase elements and providing settings of said grains."*

The respectful Examiner may see that the Claim 13 is a paraphrase copy of the cited above part of the description of PA # 10/826,001. Our unsubstantial changes include a combination in one sentence the first and second features marked by * sign within (B) part of the cited above definition. Therefore, there are no reasons to reject this claim, if our previous and further remarks are persuadable.

Thus, an originally developed and invented HTS nanotechnology results in an integer or sintered maco-ceramic material, comprising of the special solid material composition, which nano-size solid components artificially organized or nanofabricated in an invented 3D HTS nano-architecture. Our PA # 10/826,001 discloses advanced characteristics of the invented honeycomb-like superconductive nano-architecture of sintered HTS macro-ceramic sintered or solid products. Meanwhile, such superconductive nano-architecture of sintered HTS macro-ceramics is not achievable using previous HTS technology, and *US Patents # 6,617,284, #6,239,079,* and # *6,010,983* do not disclose or discuss the same or similar one.

12. The invented nano-technological advancements of PA # 10/826,001 enabled an invention and practical realization of the original consequence (flow chart) of nano-technological operations that are introduced or disclosed in PA # 10/826,001.

Consequently, newly invented and described in PA # 10/826,001 HTS nanofabrication method enables or constitutes nanofabrication of original superconductive nano-architecture of the sintered HTS macro-ceramic composite material.

Then, this superconductive nano-architecture of 3D sintered and integer macro-ceramic material controls and causes original and advanced consumer properties of HTS ceramic products or HTS electric lead or HTS wire.

Thus, the invented and originally disclosed superconductive nano-architecture facilitates and controls originally advanced superconducting properties and mechanical characteristics of HTS macro-ceramic material and nanofabricated HTS solid products for Electrical and Electronics industrial applications. These advanced superconducting properties and mechanical characteristics of HTS macro-ceramic material and nanofabricated HTS advanced solid products facilitates the fourth group of advancements and improvements of HTS advanced solid products,

including their quality characteristics that we disclose in PA # 10/826,001 and that are not disclosed in *US Patents # 6,617,284, # 6,239,079,* and *# 6,010,983* and all known prior arts.

Following five advancements and improvements substantially improve and advance key consumer properties and quality characteristics of HTS electric solid leads or HTS electric wire that were previously disclosed in the *US Patents # 6,617,284, # 6,239,079,* and *# 6,010,983.*

12) The twelfth important originality of our PA # 10/826,001 or the twelfth difference with *US Patents # 6,010,983* comprises of enormously high electric current conductivity and corresponding magnetic sustainability (at 77K temperature or in liquid nitrogen coolant environment or ambient) of the invented HTS ceramic composite lead at zero-level voltage and zero-level heat losses. Our invented HTS macro-ceramic electric lead can transfer without heating tremendous amount of electric current having density, as *"...$J_C \geq 10^8 A/cm^2$, which is a champion J_C value for any known development using YBCO ceramics."* – see [0086] of PA # 10/826,001. It substantially advance alleged achievements disclosed in a bottom of the column 2 and a top of the column 3 of the *US Patent # 6,010,983,* as *"... In particular, it can work with the critical current density J_C of $10^5 A/cm^2$ - $10^6 A/cm^2$."*

Thus, the nanofabricated HTS nano-architecture causes and controls advanced electro-magnetic characteristics of the nanofabricated HTS ceramic solid products or HTS electric leads. These or equal characteristics are not achievable using HTS technology, which is disclosed in the *US Patents # 6,617,284, # 6,239,079,* and *# 6,010,983.*

13) The thirteenth important originality of our PA # 10/826,001 or the thirteenth difference with *US Patents # 6,617,284, # 6,239,079,* and *# 6,010,983* comprises of enormously high electric conductivity and electric current carrying capacity/capability (at 77K temperature or in liquid nitrogen coolant environment) of the invented HTS ceramic composite lead at practically

unsubstantial or engineering acceptable voltage and heat losses. It is an original advancement for HTS round wire strand or filament. Our PA # 10/826,001 says in § [0091]:

*"Exceeding by 100x the engineering application limit **J** = 200A/cm² of copper wire, HTS-CSP multi-strand wire would decrease the size, weight and cost of motors, cables, transformers, and generator rotors by 5 – 10 times[13, 14, 48]. HTS-CSP wire with specific superconductive nano-architecture would also replace copper cables in the existing underground trenches to eliminate bottlenecks of the overloaded grids in city areas, which is limiting the progress and growth of computerization, businesses and life-style."*

Our PA # 10/826,001 also submits Figures 4 and 5 demonstrating advance and originally high testing results of the electric current carrying capacity of the really produced HTS wire strands (HTS-CSP is an abbreviation of the invented by us ceramic-silicone processing method of HTS ceramics). Our PA # 10/826,001 also says in § [0148]:

*"Meanwhile this HTS-CSP strand demonstrates the industrially desirable level **J** ~ 10kA/cm² at very small **E** ~ 0.001V/cm. The same HTS-CSP strand could transfer practically without overheating **I** ~ 18A or **J** ~ 106kA/cm² at engineering usable voltage **E** ~ 0.02V/cm. For comparison, **J** =1.5kA/cm² burnt out the lonely tested silver strand of 127µm in diameter..."*

Thus, a specially nanofabricated HTS nano-architecture causes and reliable controls high electric current carrying capability of the originally nanofabricated HTS multi-strand round wire. This or similar or equal advanced consumer characteristic of HTS wire are not achievable using previous HTS technology, which was disclosed in *US Patents # 6,617,284, # 6,239,079,* and # *6,010,983*.

14) The fourteenth important originality of our PA # 10/826,001 or the fourteenth difference with *US Patents # 6,617,284, # 6,239,079, and # 6,010,983* comprises of the special consumer advantages of HTS wire strand, as says our PA # 10/826,001 in § [0088]:

*"... If a nichrome substrate strand of 50µm in diameter is coated by the HTS-CSP composite coating layer of ~10µm sintering thickness, this HTS-CSP strand has the engineering effective substrate/ceramics cross-section ratio of about 1:1. Such HTS-CSP strand can transfer direct electric current of **I** ~ 0.7A or **J** ~ 20kA/cm² at 77K and insignificant **E** ~ 0.005V/cm, which is a required level of the wire's current carrying capability for highly beneficial industrial applications of such advanced wire."*

Thus, the nanofabricated HTS nano-architecture causes a substantial increase or advancement in engineering effectiveness of nanofabricated HTS multi-strand round wire. Meanwhile such or similar engineering effectiveness of HTS wire is not achievable using previous HTS technology that is disclosed in *Patents #6,617,284, #6,239,079,* and *#6,010,983.*

15) The fifteenth important originality of our PA # 10/826,001 or the fifteenth difference between our PA # 10/826,001 and *US Patents # 6,617,284, # 6,239,079, and # 6,010,983,* comprising of substantial magnetic levitation effect (at 77K temperature or in liquid nitrogen coolant environment) of the invented HTS ceramic composite bulk lead, as it says §[0033] and § [0034] and shows Figure 7:

"Figure 7. Photo picture showing magnetic levitation effect provided by dry pressed and sintered HTS-CSP tablet.
The rare-earth magnet (0.225g, 5mm in diameter) levitating in air, 7mm above a dry-pressed and sintered HTS-CSP tablet of 30mm in diameter immersed in liquid nitrogen."

Thus, the nanofabricated HTS nano-architecture causes and controls an advanced and substantially powerful levitation effect of the nanofabricated HTS macro-ceramic bulk products. Such or similar levitation effect was not achieved using HTS technology and it was not disclosed in *US Patents # 6,617,284, # 6,239,079,* and *# 6,010,983.*

16) The sixteenth important originality of our PA # 10/826,001 or the sixteenth difference with *US Patents # 6,617,284, # 6,239,079,* and *# 6,010,983* comprises of the special mechanical properties of HTS macro-ceramic lead, as says our PA # 10/826,001 in § [0083]:

"... under mechanical impacts this nanostructure makes possible grain-boundary sliding causing the enhancing fracture toughness and ductility of the HTS-CSP solid products. Indeed, we successfully machined HTS-CSP slip cast plates using a diamond saw and a drill tool."

Thus, the nanofabricated HTS nano-architecture causes advanced mechanical quality characteristics of the nanofabricated HTS macro-ceramic products that are not achieved using HTS technology, which was disclosed in *US Patents # 6,617,284, # 6,239,079,* and *# 6,010,983.*

Conclusion of Remarks

1. As we described in the previous sections 2 – 8, only single and isolated elements of the raw material compositions and full sets of technological operations or technological flow-charts of the referred by the respectful Examiner *US Patents # 5,529,981 (Holloway), # 5,660,774 (Stangle, et al),* and *# 5,866,515 (Dorris, et al*) are similar with the single and isolated elements of the raw material composition and technological operation set or technological flow chart of our PA # 10/826,001. Moreover, these three patents teach different technologies that do not used either in our PA # 10/826,001 or *US Patents # 6,617,284, # 6,239,079,* and *# 6,010,983.* Moreover, technologies, which are described in the *US Patents # 5,529,981, # 5,660,774,* and *# 5,866,515,* can result in production of different materials and products with different quality characteristics.

The *US patents # 5,529,981 (Holloway), # 5,660,774 (Stangle, et al),* and *# 5,866,515 (Dorris, et al*), do not claim or even discuss the same structural and consumer properties of the allegedly produced HTS products. Meanwhile a focus of our PA # 10/826,001 is the unique set of advanced electro-magnetic, mechanical properties, durability and reliability of the newly invented and really produced "**SINTERED CERAMIC COMPOSITE LEAD WITH SUPERCONDUCTIVE NANO-ARCHITECTURE**" or sintered HTS bulk ceramics or 3D HTS products or HTS round electric wire. Again, the respectful Examiner pays attention to only partial coincidences of the single and isolated elements or features or characteristics of the each one of three *US Patents # 5,529,981 (Holloway), # 5,660,774 (Stangle, et al),* and *# 5,866,515 (Dorris, et al*) with the single and isolated elements of the raw material composition or technological operation set of our PA # 10/826,001. Additionally, using *US Patents # 5,529,981, # 5,660,774,* and *# 5,866,515* or other known references, any one group of specialists having either ordinary or extraordinary skills cannot copy or repeat the invented HTS nanotechnology and produce the invented HTS macro-ceramics or HTS lead, as it is disclosed in our PA # 10/826,001.

Thus, it is inapplicable for both claims and an entire description of our PA # 10/826,001 to object or oppose invented and disclosed in our PA # 10/826,001 raw material composition or a technological operation set using coincidences with just single and isolated elements or features or characteristics of three different and isolated from each other US Patents. This makes inapplicable for both claims and the entire description of our PA # 10/826,001 a statement of the respectful Examiner, as "... *identical or substantially identical in structure or composition or are produced by identical or substantially identical processes, a prima facie case of either anticipation or obviousness has been established ... 562 F.2d1252, 1255, 195 USPQ 430, 433 (CCPA 1977)"* – see Art Unit 1793, page 6, paragraph 3.

As we described in the previous sections 2 – 12, any invention disclosed in our PA # 10/826,001 was derived from the inventors (Rokhvarger & Chigirinsky) of this application and is thus not an invention "by another" in view of the *US patents # 5,529,981 (Holloway), # 5,660,774 (Stangle, et al)*, and *# 5,866,515 (Dorris, et al)* and other known references.

As we described in the previous sections 3 – 8, all arguments provided by the respectful Examiner in the Art Unit # 1793 of 04/17/2008 in a view of the *US patents # 5,529,981 (Holloway), # 5,660,774 (Stangle, et al)*, and *# 5,866,515 (Dorris, et al)* are inconsistent to object our PA # 10/826,001. Therefore, referred by Examiner 35 USC § 103 (a) (see Page 4 of the Art Unit # 1793 of 04/17/2008) is inapplicable for an objection or rejection of our PA # 10/826,001 and its claims and description.

2. We identified and described sixteen (16) major substantial advantages with or differences between our PA # 10/826,001 from one hand and *US Patents # 6,617,284, # 6,239,079, and # 6,010,983* from another hand. Our PA # 10/826,001 actually discloses a set of 16 substantially original advancements in raw material properties, raw material composition, technological operations and their consequence (flow-chart), macro-material nano-structure, and

advanced and original combination of and originally advanced electro-magnetic, mechanical properties, durability and reliability of the newly invented and really produced "SINTERED CERAMIC COMPOSITE LEAD WITH SUPERCONDUCTIVE NANO-ARCHITECTURE" or sintered HTS bulk ceramics or 3D HTS products or HTS round electric wire.

As we described in the previous sections 5 – 12, nine major features of the invention disclosed in our PA # 10/826,001 where we disclosed nine major original operations or parameters of the original HTS nanotechnology resulting in at least seven original characteristics of the HTS solid (sintered) material nano-composition and nano-structure and quality advancements of original HTS macro-ceramics and HTS electric leads, including HTS round wire. Therefore, using *US Patents # 6,617,284, # 6,239,079, and # 6,010,983* or other known references, any one group of specialists having either ordinary or extraordinary skills cannot copy or repeat the invented HTS nanotechnology and produce the invented HTS macro-ceramics or HTS lead, as it is disclosed in our PA # 10/826,001.

As we described in the previous sections 2 – 12 of the current remarks, any invention disclosed in our PA # 10/826,001 was derived from the inventors (Rokhvarger & Chigirinsky) of this application and is thus not an invention "by another" in view of the *US Patents # 6,617,284, # 6,239,079,* and *#6,010,983* and other known references.

These all overcomes an alleged rejection of certain claims and entire description of our PA # 10/826,001 under 35 U.S.C. 103(a) referring the *US Patents # 6,617,284, # 6,239,079,* and *# 6,010,983* and other known references. Meanwhile, the authors of PA # 10/826,001 agree to add *US Patents # 6,617,284, # 6,239,079,* and *# 6,010,983* in a list of references or Notice of References Cited, which will be attached to our pending PA # 10/826,001.

3. Thus, all known references applied in combination with the above discussed references do not provide any pertinent features which can be considered as similar to the

present invention as defined in claim 21 and added or specified in claims 22 – 29. It is therefore respectfully submitted that the obviousness rejections applied by the Examiner are not correct. Consequently, all official US PTO documents or cited patent rules precedents, that were referred by the respectful Examiner to object any part of the Description or reject claims of our PA # 10/826,001, do not applicable.

Following suggestions of the respectful Examiner, we corrected terminology, certain words, used numbers, and phrases of our claims in order to put them in full correspondence with the content, wording and terminology of the Summary, Drawings and their Description, Description of the Preferred Embodiments, References, and Examples of our PA # 10/826,001.

It is believed to be advisable to explain the present invention as defined in claim 21, the broadest claim on file, as:

A superconductive nano-architecture of the full dense sintered high temperature superconducting (HTS) macro-ceramics or three-dimensional (3D) HTS ceramic electric lead comprises of geometrically interdependent and especially composed original and nao-size A) and B) solid components, where

A) Nano-size HTS ceramic crystal grains that uniformly aligned in *a-b* crystallographic planes and silicate glass or metal or inorganic nano-thick or nano-size films or dots.

B) A solid nano-structure comprising honeycomb-like three dimensional setting network in which said silicate glass or metal or inorganic nano-thick or nano-size films or dots locate in nano-thick boundary areas of the nano-size superconductor ceramic crystal grains, so as to cage and surround the latter.

As we showed above, all known prior arts do not disclose eleven interrelated raw material nano-characteristics and nano-technological operations that constitute original and advanced HTS nanotechnology, which facilitates superconductive nano-architecture of HTS macro-ceramics. Said superconductive nano-architecture of said HTS macro-ceramics causes

or controls or quality assures extraordinary advanced electro-magnetic and mechanical properties and durability of the advanced HTS electric leads, including HTS round wire.

The above mentioned specific and original features that are defined in claim 21, with their inter-junction, with their interaction, with their interdependence and inter-influence provide the highly advantageous and practically useful results which have never been achieved before in the industry, that, as explained herein above, desperately needs a reliable HTS electric lead with highly advantageous properties achieved or controlled by the present invention.

Taking in account following remarks (see 12 sections of the above remarks), it is respectfully submitted that claim 21 and the dependent claims are written in full correspondence with reasonable advices of the respectful Examiner and a specification of the initial PA # 10/826,001. The claim 21 should be now considered as patentable distinguishing over the art and should be allowed. The dependent claims 22 – 29 depend on claim 21 and share its presumably allowable and original features. Therefore, it is respectfully submitted that all new claims should be allowed and ***35 USC §112*** is not applicable for them.

In particular, the invented superconducting ceramic lead of the present invention has exceptionally high quality assurance, which provides its outstanding efficient service with reliable and extraordinary advanced superconducting electro-magnetic and mechanical properties and durability.

Reconsideration and allowance of the present application is most respectfully requested.

Should the Examiner require or consider it is advisable that the specification, claims and/or drawings be further amended or corrected in formal respects in order to place this case in condition for final allowance, then it is respectfully requested that such amendments or

corrections be carried out by Examiner's Amendment, and the case be passed to issue. Alternatively, should the Examiner feel that a personal discussion might be helpful in advancing this case to allowance; he is invited to telephone the undersigned (at 631-243-3818).

Respectfully submitted,

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